Designing a Volunteer Experience:

Waders, Pipe Cleaners, and Glitter

A PROJECT

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We abuse the land because we regard it as a commodity belonging to us. When we see the land as a community to which we belong, we may begin to use it with love and respect.

Aldo Leopold

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Contents

Preface

For a long time, I wanted to do something to have a more positive impact on the environment, but I did not know what to do beyond the basics like recycling. Then one day, a little over six years ago, I saw an advertisement in a community newsletter looking for volunteers to monitor local wetlands. That summer I stepped into waders for the first time and learned to love a part of the environment I had never given much thought to previously. Every summer since, I have worked with great people in the Wetland Health Evaluation Program monitoring the health of wetlands that are part of the watersheds of northern Hennepin County.

A couple of years after I had joined WHEP, I had the opportunity to return to school and study sustainability. When writing my statement of purpose to gain admission to the Master of Liberal Studies program, the thing I kept coming back to when I thought about how we would be able to bring about a more sustainable world was people. All the fancy technologies in the world will not be enough; people must choose to make more sustainable decisions if we are to overcome the environmental challenges we are facing. This became the focus of my studies. How do we get people more engaged with the environment and making choices that are better?

When it came time to decide what exactly I wanted to do for my thesis, I wanted to figure out a way to incorporate WHEP into my research. I chose to focus on volunteering as a way to engage people with the environment. I wanted to understand why people chose to join volunteer programs that focus on the environment and how to get them to stay in their chosen programs. I had taken a course on design thinking and was intrigued by its human centered approach to creating innovative solutions. This focus on the people for whom a project or a program is being designed led me to think about how design thinking could be used to improve how volunteers experience the program for which they are volunteering. In particular, I wanted to find ways to help make WHEP a stronger program.

Introduction

There was a time in the not too distant past when rivers caught fire because of the pollution contaminating the water, and people were sickened or even killed by toxic clouds of pollution sweeping through their towns. Today, pollution's presence may not be so blatantly obvious, but is no less serious and are arguably more insidious. The pollution we are sending into the atmosphere is changing the entire climate of the planet. The pollution of our waters is causing mutations in frogs—an indicator species—and unknown consequences for our own species. Due to these problems we are facing many and various challenges. They are not challenges that one person or a single technological advance will solve. The only way we will overcome the problems we have created is to encourage as many people as possible to become engaged and work to improve the threats to our environment and way of life.

Wetlands are a critical element in an ecosystem. They provide habitat for a wide variety of insects and wildlife, especially migrating waterfowl. Wetlands help to manage the flow of water through the landscape by acting as a reservoir for excess rainwater, thereby reducing flooding and helping to recharge groundwater reserves. They also filter the water that flows through them, removing sediment and pollutants before

Figure 1 Example of a wetland that would be typical of those monitored by the Wetland Health Evaluation Program. Photo credit Jena Gray.

they can reach our lakes and rivers. These functions are of critical importance in maintaining a healthy ecosystem. Despite this, many are filled in and destroyed because they are often perceived as ugly, unimportant swamps standing in the way of something better, often agricultural land in rural areas or development in urban/suburban areas. However, wetlands are crucial to understanding the health of our ecosystem and how our actions impact that health.

Wetland Health Evaluation Program

The focus of my research is the group of volunteers in the Hennepin County (Minnesota) Environmental Services' Wetland Health Evaluation Program (WHEP). WHEP uses volunteers to monitor the health of "depressional wetlands" (i.e., wetlands with open water) within the county. The volunteers are split into teams covering certain geographic areas within the county—typically a city or watershed that is a program sponsor (e.g., Bloomington, Minneapolis, Minnetonka, Eden Prairie, Elm Creek Watershed, and Shingle Creek Watershed). Volunteers collect data on local wetlands' macroinvertebrates (i.e., aquatic insects) and vegetation populations. Volunteers attend three training sessions to prepare themselves for what they will be doing during the season. One training session focuses on field methods, so that volunteers know how to set traps to collect macroinvertebrates and set up a plot for surveying the vegetation before going out into the field. The other two training sessions concentrate on teaching volunteers how to identify the collected macroinvertebrates and how to identify vegetation while in the field.

The volunteers then spend the summer out in their assigned wetlands with their team leader—a seasonal Hennepin County employee. Each wetland is visited three times. The first visit—typically in June—is to set bottletraps to collect macroinvertebrates that the volunteers will pick up two days later. The bottletraps are designed to let the macroinvertebrates swim into the trap, but become unable to figure how to swim out. The bottletraps aim to collect the wetland's nocturnal and slower-moving macroinvertebrates. On one of these visits, the volunteers will also take a dipnet

sample to collect faster-moving macroinvertebrates. All the macroinvertebrates are preserved in order for the volunteers to be able to identify them later in a lab setting, using microscopes. Later in the summer—typically in July—the volunteers revisit each site in order to survey the wetland's vegetation. They set up a 100 m^2 plot in an area that is representative of the wetland's plant community and identify every plant within the plot.

The work WHEP volunteers do is important for several reasons—apart from the benefits volunteers gain from volunteering in their communities. Monitoring biological indicators provides information that water chemistry tests may miss. If a pollution event occurs intermittently and is flushed from the system before water chemistry tests are done, the results of those tests will always be negative. Monitoring macroinvertebrate populations can detect intermittent pollution because of its negative impact on a species that is sensitive to the pollutant. This impact make lead to the reduction of the numbers or even the loss of the species in the effected wetland. (Mason 2002). The cities that support WHEP's efforts choose which wetlands that volunteers monitor. This enables cities to establish an historic record of the health of wetlands within the city's limits. It also allows the city to monitor how new development or other changes to an area impact a wetland's health and the changes that may need to be enacted to mitigate a negative impact (A. Schwartz, personal communication, May 2012).

Recruiting and maintaining a volunteer corps

Volunteering is a commitment that does not provide an economic return upon one's investment of time, so there must be something of intrinsic value being gained by those volunteering. For this reason, a strong, consistent, and reliable volunteer corps is something every organization needs to invest great effort in recruiting and maintaining. Such organizations need to be responsive to the needs of their volunteers and show volunteers that they are critically important to achieving the organization's mission and that the work they are doing matters. My thesis explores the psychological motivations and satisfactions of volunteers of an environmentally focused program and how design

thinking can be used to improve a program. It is not an evaluation of design thinking. It is concerned with the ways in which the theories and practices of design thinking can help discover and implement new ways of improving the relationship between an environmentally focused program and its volunteers.

Design thinking's focus

Design thinking's main feature is that it can be human focused in its application of design to issues outside traditional design fields (e.g. architecture, interior design, graphic design, landscape design, industrial design, fashion design). Tim Brown, a leading design thinker, sees designers as people who begin with a focus on a single subject and then broaden this knowledge base into many different subjects (Berger 2009). According to Michael Bierut of the design firm Pentagram, design includes "a plan to make something, for a specific purpose, with a specific audience or user in mind" (p. 30). Designers go through a process of developing new or improved products or places in roughly the same ways regardless of the discipline. It "generally involves conducting research (including, in some cases, deep digs into human needs and wants), creating sketches and models so that ideas can be shown to others and analyzed, and continually reworking and refining an idea or possibility, in response to feedback or new ideas" (p. 45). This process that designers go through is what design thinking is trying to disseminate beyond the sphere of traditional design. It is an iterative process about learning and also consciously working to improve whatever is being designed. Characteristics of the design thinking process include:

- Asking people what their needs are, rather than assuming to know what their needs are
- Focusing on people's needs
- Observing the current product or process in action to find what is working and what is not
- Being confident in success; continually going back to refine products and processes

- Having a goal orientation without being predictive
- Using multidisciplinary teams to work towards solutions
- Brainstorming and prototyping ideas to keep design process moving forward

These characteristics set design thinking apart and make it a good and effective way to tackle difficult or unusual problems.

Design thinking and volunteering

Volunteering for environmentally focused programs that work to monitor or to improve the environment is a vital way to engage and connect individuals and communities to their natural environment. Through the use of design thinking, the volunteer experience can be enhanced by increasing the retention of volunteers, creating stronger volunteer programs, and developing individuals and communities that are strongly connected to and engaged with their natural environment.

Volunteers of Hennepin County's Wetland Health Evaluation Program (WHEP) served as the case study for this present research. WHEP volunteers spend the summer months collecting aquatic insects to be identified later in a lab setting. They also identify the vegetation in wetlands throughout the county in order to assess the state of local wetlands. I surveyed the volunteers of WHEP's 2013 season to understand how they viewed both volunteering in general and volunteering for a specific environmentally focused program. Volunteers were then invited to take part in a design thinking workshop that focused on some of the concerns raised by volunteers in the survey. During the workshop, volunteers developed and prototyped ideas they believed would help enhance their own experience and that of other program volunteers.

Overview of the thesis

First, the phenomenon of volunteerism will be examined through the lens of psychology to understand why people volunteer and what they are getting from their experiences. Second, the methodology concerning both the survey of and design thinking workshop with WHEP volunteers will be covered. The results of each will then be discussed. Lastly, the implications for the program and beyond will be covered.

Chapter 1: Volunteering

There are many ways in which people may get involved in their community. There are also many things an individual can do to help humanity move toward a more sustainable planet. One way to combine the desire to be involved and take action in helping the planet is through volunteering for an environmentally focused program that aims to monitor or improve environmental conditions. Psychological research—especially that of social psychology—on volunteering has so far been largely restricted to social causes and also to volunteers who are in college or retired. Little research has been done on volunteers belonging to environmentally focused programs and the differences, if any, between volunteering for environmental causes and social causes.

Psychology of volunteering

Volunteering is an unusual phenomenon that many find difficult to understand because the rewards for taking part in a voluntary endeavor are not readily apparent. Several academic fields investigate why people volunteer, including economics, sociology, and psychology. For an example from economics, Carpenter and Knowles Myers (2010) investigated whether extrinsic incentives—stipends for volunteer firefighters for responding to calls in Carpenter and Knowles Myers research—affected the willingness of volunteers to contribute more time to an organization. What they found is that it can increase time contributed; however, if the volunteers are contributing their time for altruistic reasons, offering extrinsic incentives will most likely backfire on the organization. For the purposes of my thesis, I will be using psychology as the lens to view the phenomenon of volunteering.

There has been much research into how the act of volunteering impacts the individual, both psychologically and physically. Thoits (2012) discovered that positive emotional and physical health is related to the construction of the individuals' prominent identity, in part from the positive effects of volunteering. In other words, when being a volunteer becomes an important part of who they are, the volunteer will

have a greater sense of value, which leads her or him to feel as though they are living a meaningful and purposeful life; this in turn benefits the volunteer's physical and emotional health. This is quite a complicated sequence of events in which something unexpected or startling could perhaps change the positive condition of the volunteer's emotional and physical health. Vecina and Chacón (2013) have found that it is important that the reason for volunteering is based on either a pleasure-based prosocial motivation or the expectation of a positive affect due to being a volunteer. Having one of these motivations to volunteer leads the volunteer to having a greater sense of happiness and psychological wellbeing. Volunteering as a family also can be important to developing strong bonds of the family relationships (Lewton and Nievar, 2012). An adolescent volunteering with their family is less likely to have self-esteem issues and engage in risky behaviors when he or she spends time in the presence of a model of good behavior in the parent they are volunteering with. This is relevant to WHEP, as the program will occasionally allow a minor to participate if at least one of their parents volunteers alongside them.

The environment

Environmental behavior

In order to understand volunteering for environmentally-focused program, it is important to understand the attitudes and behaviors people have towards the environment in general. Environmental/ecological psychology developed in the 1960s to understand the intersection of human behavior and the physical context in which it takes place. But, as Gifford (2007) puts it, the research done at the time "lacked a sense of urgency" (p. 200). It was not until the 1980s, as more and more evidence of environmental crises mounted, that environmental psychologists turned to understanding these crises and how people influence them and how they influence people. Environmental psychologists have been focusing research efforts more specifically on issues like sustainability, public policy—including influencing it—and technological advancements and reaching out to other disciplines, such as ecology and sociology, to work collaboratively on issues.

Behavior and how it can be changed

Understanding why a person makes a sustainable decision and how to have them make more sustainable decisions is well studied. Behavior is a function of the person and the situation they find themselves in. This is explained by the dual process theory which states human behavior is dictated by two separate systems of reasoning that control our actions. The first, the automatic system is older evolutionarily. It is not consciously controlled and is based in our emotions. We react immediately because it is connected with our heart or gut instinct. The second, the deliberate system comes later in our evolutionary development and is rational and careful in its decision making. It comes from our head. The first (automatic) system often wins out because of its speed in making a decision and not reviewing all options systematically. It often goes for the easiest option available. In regards to the environment, this means if a person is to make a decision that would benefit the environment the conditions must be right and it must be the easiest choice for the person to make (C. Manning, personal communication, September 2010; Sloman 1996).

This dichotomous way of thinking helps to explain why a person will bring reusable bags to the store, but will load them into a SUV to bring them home. Research does not really explain how we have reached this point; however, the shift in our culture after World War II may have something to do with it. After World War II, technological advances were being made in the name of progress. These advances were designed to make life easier, and convenience products, like processed foods, became the norm and largely ignored any consequences to the environment. They were designed to cater to the automatic reasoning system. How can we make environmentally friendlier choices become the “convenient choices”?

Manning (2009) puts forth a detailed strategy to turn decisions about a person’s environmental behavior normally made by the deliberate system into ones that can easily be made the automatic system. By doing the following things, people and organizations who desire to change the negative environmental decisions of others can

influence those people to change their behaviors to more sustainable behaviors in the following ways:

- Make sustainable behavior the social default
- Emphasize personal relevance
- Make hidden information visible
- Foster mindfulness
- Create opportunities for competence, skills, and knowledge
- Make change a byproduct of other events
- Balance urgency with realistic hope

Making sustainable behavior the social default means that the more people who are openly making a sustainable action, the more it is likely others will start doing the behavior. For example, if eight households in a neighborhood start setting out recyclables for collection, the other four households may start putting out recyclables for collection, especially if the original households talk positively about what they are doing with the other neighbors (pp. 8-10).

Another strategy for changing behavior is to make the change relevant to the person whose behavior you would like to change. For example, you do not want to tell a person it is good for the environment to buy an Energy Star rated appliance. You want to tell them they will save money on their electric bill by using such an appliance (p. 12).

Many environmental problems are ones not readily seen by your average person, and there may be a disconnect between the products we use and their origins. In order for people to understand, you must make the connection and relevance visible to them. For example, there are stickers for placement on paper towel dispensers that remind people they are using a product that is made from trees, and this reduces the overall consumption of paper towels from labeled dispensers (17).

In order to change to more sustainable behavior, it is also important to get people out of the automatic system of reasoning and persuade them to be more

mindful of their decisions. One way to do this is to present a person with surprising information; this will engage their deliberate system of reasoning and make them think before acting (pp. 19-20).

People must feel confident in what they are doing in order to continue behaving in a certain way. The best method to accomplish this is to allow people to practice a particular skill in a friendly environment where they have access to resources that will help them grow comfortable with what they are doing (p. 22).

Behaviors can be changed by making them the byproduct of something else. People get stuck in a habit of doing something a certain way and it is not easy to get them to get them to change. One way to get them to change is to make the more sustainable choice one that is easier than the less sustainable alternatives. It is also a good time to try to change behavior when a person is at a changing point in their life such as the birth of a child or some other major life events (pp. 23-24).

When trying to elicit sustainable behavior change, there is also a balancing act that one must employ between creating a sense of urgency to get people to act and maintaining a sense of hope about the situation. Leaning too far in either direction might prevent people from acting out of fear leading to denial, or on the other hand making it seem like everything is okay and the situation is being handled. This can be done by being aware of the bigger picture, but focusing efforts on smaller, more localized goals (p. 26-27 For example, instead of focusing on eliminating the dead zone in the Gulf of Mexico where the Mississippi River empties into it, the environment would be better served if a person were to focus on a water body or watershed in their immediate community and join a program like WHEP.

Participating in WHEP offers the volunteers a chance to experience some of these strategies. It makes them aware of an aspect of the environment that most ignore. Going out into wetlands allows them to gain competence and knowledge firsthand about the health of wetlands in their community. Finally, when they talk with others about their experiences, they are starting to change the social default by

showing others that it is okay to care about an ignored part of the environment and that getting involved in making a difference with the environment is possible for anyone to do.

Citizen Science

"Citizen science" is relevant to this thesis, in that it is concerned with volunteers, who do not necessarily have a scientific background, but who collect and/or process data to contribute to scientific knowledge (Alabri and Hunter, 2010). For example, the National Aeronautics and Space Administration (NASA) has established many programs that involve citizens in their research, including helping to improve maps of Mars or monitoring meteoroids impacting the dark side of the moon (NASA, n.d.). In regards to the environment, citizen science typically concerns those volunteers who are actively monitoring or working to manage the environment or an aspect of it (Conrad and Hilchey, 2011). Examples of this would include Cornell University's Laboratory of Ornithology's and the British Trust for Ornithology's various programs enlisting volunteers to survey birds in their communities (Bonney et al., 2009; Brossard, Lewenstein, & Bonney, 2005; Silverton, 2009) and, of course, WHEP.

History of citizen science

Citizen science has a long history, though the term was most likely coined in the 1970s (Mayer 2010). People have always been curious about the world around them and have been recording their observations for centuries. The line between the citizen scientist and the professional scientist was blurred early on. Carl Linnaeus (1707-1778) relied on a network of people to provide him with observations and collections of specimens from around the world that made his taxonomic work possible (Miller-Rushing, Primack, & Bonney, 2012). Philosopher Henry David Thoreau made observations of nature at his home on Walden Pond. Thoreau's observations would now be considered records of phenology—the study of the relationship of annual occurrences (e.g., migrations, trees leafing out or flowering, etc.) to the changing seasons and, more recently, the changing global climate (Mayer 2010).

For the last 150 years, the line between citizen scientist and professional scientist has become well defined as the traditional scientific method and the need to replicate experiments have become the norm. Despite this, citizen science has continued to flourish for two main reasons. The first reason has to do with the scale of many of the challenges facing the environment due to pollution and global climate change, all of which require large amounts of information from wide geographic areas in order to understand what is happening to our planet (Miller-Rushing, Primack, & Bonney, 2012). A small team of professional scientists would never be able to collect enough data to understand the wider implications of a particular issue, but having a network of data collectors makes it possible.

Citizen science and local environment

The second reason that citizen science is flourishing is because of its ability to focus on an issue of local importance that would contribute little to the wider understanding of science in general (Miller-Rushing, Primack, & Bonney, 2012). For example, if a person noticed that there are no longer frogs in a pond near their home, but there are still frogs in a pond a short distance away, it is unlikely the person would be able to convince a professional scientist from the local university to investigate. If they wanted to know what happened to the frogs in that pond, they might well find it necessary to conduct the research themselves or else mobilize local citizens who are interested in the same or similar problems.

Citizen science programs introduce people to the environment, teach them about it, and, most importantly, encourage them to become involved with it. As Alabri and Hunter (2010) state, "Citizen science is democratizing science in that it enables public citizens and the scientific community to work together in monitoring, managing, maintaining, and understanding the environment around us." Conrad and Hilchey (2011) examine the issues and opportunities surrounding "community-based monitoring"—the term they use for citizen science that involves environmental monitoring. The issues they raise do not necessarily apply to all citizen science programs, but they do provide a

valuable overview of the good that can come from such programs and the hazards that programs must work to minimize.

Issues concerning citizen science programs

Here we will review a few of the issues raised, both positive and negative, and how they pertain to WHEP. First, community-based monitoring programs increase environmental democracy by sharing information. WHEP provides results of each season's monitoring efforts to its volunteers and posts the results on its website (www.mnwhep.org) for the public to access. Community-based monitoring programs can provide data to governments at no cost, but often have trouble finding sources of funding. However with WHEP, the cities and watersheds—Minneapolis, Eden Prairie, Bloomington, Minnetonka, Elm Creek Watershed, and Shingle Creek Watershed—in which the volunteers are monitoring wetlands sponsor the team and cover the costs of supplies and the team leader's salary. Another benefit to community-based monitoring is that ecosystems that might not otherwise be monitored are now being monitored. This is largely true of WHEP, the Minnesota Pollution Control Agency released just last year the first assessment of the state's wetlands (Genet, 2012), a first of its kind assessment in the entire country.

One problem Conrad and Hilchey state is that community-based monitoring program have problems with data accuracy due to insufficient monitoring expertise and poor quality control and quality assurance. However, WHEP has training sessions every season to teach volunteers how to collect and properly identify local macroinvertebrates and vegetation they will be encountering in the field. As for quality of the data generated, WHEP has each team cross-check one site from another team's set of sites to see if similar results are obtained (e.g., if Team A has five sites assigned to them, one of the sites will be one of Team B's sites and one of Team C's sites will also be monitored by Team B and so on). WHEP also has both the macroinvertebrate and vegetation results of one site for each team checked, typically by the program's coordinator or by someone from an outside environmental consulting firm who advises

the program. This allows WHEP to produce high quality and accurate data. Another problem of community-based monitoring is having volunteers monitor something just for the sake of monitoring it. This is a potential issue with WHEP because only the representative of one of the cities involved has ever met with volunteers and explained how they use the data generated through WHEP.

When citizen science programs are carefully designed and implemented to ensure that the data generated is accurate, they can be a valuable addition to science and the effectiveness of the particular team or teams. Professional scientists are realizing this fact more and are becoming aware that they have an untapped source to assist in their research endeavors—a source which is increasingly easier to reach and train in proper research techniques due to technological advances. Public outreach related to the professional scientists' research is also becoming a required part of their request for funding in order to obtain funding from places like the USA's National Science Foundation or the UK's Natural Environment Research Council (Silvertown, 2009). There is much to be gained from citizen science programs for the environment, for society, and for the individuals participating in the programs.

Chapter 2: Methodology

My thesis combines psychology's viewpoint on volunteering and the practice of design thinking. I chose to use psychology as the lens for the phenomenon of volunteering because of psychology's roots in trying to understand human behavior. I wanted to have a better understanding of why people wanted to become volunteers—especially those of environmentally focused programs—and what they were getting from their experiences that kept them coming back to the organization they chose to volunteer with. I believe that understanding these things can help organizations recruit more volunteers and better their retention rates of current volunteers.

However, it takes more than just understanding why volunteers have come to your organization and what is keeping them there. Organizations need to use the knowledge in order to improve how volunteers feel about their experiences with the organization. There are many ways an organization could do this. The way I chose to do this for WHEP, is through the use of design thinking. What I like most about design thinking is that its focus is on the person or people the solution is being designed for. It is all about the person and discovering what they need either through talking with the person or observing them in the process you are trying to help them improve and make easier for them. Design thinking can also be used to empower people to create their own solutions. This is what I did with the volunteers of WHEP.

Combining psychology and design thinking

At first glance, psychology and design thinking are two disparate disciplines that at first might not seem to make a good partnership. Psychology is traditional, linear in its research path. Design thinking is non-traditional, winding its way to a solution through multiple prototypes and revising based on feedback concerning the prototypes until the best possible prototype is ready for implementation. However, I believe that the two disciplines can be combined. Psychology's desire to understand why people do the things they do plays directly into design thinking's empathetic, human-focused

approach to problem solving. Psychology can be used as a tool in discovering and defining the problem at hand and then design thinking can be used to develop a solution. The traditional and non-traditional can be successfully integrated to create a strong partnership.

However, I had to figure out how combine psychology and design thinking. Psychology tends to work in a linear fashion following the scientific method: a hypothesis is drawn, experiments are devised and conducted, and conclusions are made that prove or disprove the hypothesis. Design thinking does not move in such a manner. Design thinking can start with defining the problem—stating a hypothesis—but then moving on to creating a solution through rapid brainstorming and prototyping ideas to test, continuing to circle back until a good solution is found. The process does not aim to prove that a hypothesis is right, but aims to find the best solution in a particular context.

The "right solution" will bring about an improvement to whatever the challenge may be, but there can also be unforeseen consequences. For instance, IDEO—a company that specializes in helping businesses by using design thinking—worked with the healthcare company Kaiser Permanente to improve care of patients in Kaiser's hospitals. One of the problems tackled by a team of designers from IDEO and individuals from various departments within Kaiser Permanente was to work with nurses to improve the hand-off of patient care between shifts. Nurses invested a great amount of time on the transition. Often, however, important information on a patient's care and well-being was not passed on to the new shift's nurses, leaving the patient feeling that a gap had occurred in their care. The IDEO team observed that nurses would be scribbling notes about each patient on whatever was available to them at the time, and this sometimes meant the nurses' scrubs. In a short time, the team developed a prototype which moved the passing along of information for the nursing station to the patient's bedside, using a simple software program to record the notes throughout a shift that would need to be passed on to the next shift. These innovations cut in half the time it took nurses on the new shift to make their first contact with patients. In addition to

helping improve patient care, this system also helped to improve the nurses' work experience by allowing them to get to their duties faster and helps ensure they got their duties finished by the end of their shift (Brown 2008).

If Kaiser Permanente had not taken a chance by using design thinking, patients would still feel as though they were suffering a lapse in care every time new nurses came on duty. Nurses would still be spending a significant portion of the start of their shift and staying past the end of their shift to share patient information with each other. IDEO designers created a multidisciplinary team from Kaiser Permanente on a journey to improve patient care by focusing on the patients' needs, and observed what was going on in their hospitals, and rapidly prototyping ideas to find out which ones worked best to improve patient care.

Most non-profit organizations and government sectors probably cannot afford to hire a firm like IDEO to observe their volunteers and help them to develop strategies that can help them enhance the experiences their volunteers are having. That does not mean that design thinking is tool they cannot use. Organizations can use surveys, a tool they are likely familiar with, to uncover the psychological motivations, satisfactions, and effective outcomes their volunteers are getting from their experience and where the organization is not meeting the volunteers' satisfactions. They can use this information, as I did with WHEP volunteers, to focus the direction of a design thinking workshop with their volunteers to generate and prototype solutions.

Survey design

In order to understand why WHEP volunteers were participating in the program and what they were getting from their experience, I surveyed WHEP volunteers participating in the 2013 season. The survey was made available to volunteers after they had the opportunity to participate with their team members in the field. The survey also served to form a foundation for the later design thinking workshop by illuminating ideas and concerns volunteers had about the program. The survey was written in consultation

with Mary Karius, WHEP's coordinator, and Angie Timmons, Hennepin County Environmental Services' Communication Coordinator.

The survey was designed to gain insight into the volunteers' opinions on volunteering in general to gauge how they felt about the concept of being a volunteer and its importance. Questions specifically regarding WHEP were also asked to understand why they participate in the program, what they are getting from their experience, and what they feel is and is not working about the program. Volunteers were also asked if they also volunteered for other causes and if they perceived any difference between volunteering for an environmentally focused program, like WHEP, and volunteering for a program which is focused on other social causes. See Appendix B for the complete survey.

Design thinking workshop

Over the course of my Master's program, I have taken classes in design thinking and participated in several design thinking workshops. I used these experiences and what I have learned from them to develop the workshop I held for WHEP volunteers. The workshops I participated in have followed a format that moved through the design thinking process similar to that outlined by Tim Brown in his 2008 article *Design Thinking*. Brown believes that design thinkers move on a circular continuum through three "spaces":

- Inspiration: A problem or opportunity that presents the need for a solution—identified by the survey of WHEP volunteers
- Ideation: The creation of and prototyping of ideas aimed at solving the problem—the focus of the workshop with WHEP volunteers
- Implementation: Bringing the refined solution to fruition—what Hennepin County Environmental Services will hopefully do with the ideas generated by WHEP volunteers

For the workshop, volunteers who attended were split into two groups. Volunteers are split into teams for their wetland monitoring, however, for the workshop these teams were ignored and the volunteers worked with people from other teams. To start, introductions were made and volunteers were introduced to the concept of design thinking. Then, the groups competed against each other in the Marshmallow Challenge. The Marshmallow Challenge was created by Tom Wujec as an exercise in "collaboration, innovation, and creativity" (Wujec, n.d.). For the challenge, the teams must construct a free-standing tower using 20 stick of spaghetti, a yard of masking tape, a yard of string, and one marshmallow which must sit, intact, at the top of the tower when it is finished. The teams must design and construct their tower in only 18 minutes. When the 18 minutes are up, the towers are measured to see which team has the highest tower. In a short period of time, it allowed the teams to go through Brown's design thinking spaces. The challenge of building the tower was their inspiration. The volunteers had to quickly come up with their plan on how to achieve the highest tower they could (ideation). They then had to implement that idea before the 18 minutes were up.

The groups then tackled questions raised by concerns volunteers expressed in the survey. First, they worked individually to generate ideas they thought would address their concerns and wrote them on sticky notes to post on the wall near their table. Once this was done, each group sorted their group's ideas into similar categories. They then chose one of those ideas to prototype using craft materials (e.g., pipe cleaners, glue, markers, fake plants, glitter, etc.) that were provided. The workshop

Figure 2 Craft table from the design thinking workshop.

wrapped up with the volunteers discussing their prototype and sharing other ideas they had come up with.

The need for motivated and satisfied volunteers working to monitor environmental conditions and working to improve conditions is crucial to meet the challenges we are facing with degrading environmental conditions. Using the combined forces of psychology and design thinking, organizations can increase the satisfaction of volunteers. Providing volunteers a survey to elicit responses on the psychological motivations and satisfactions of their experiences and to reveal areas that may not be meeting their expectations can provide the foundation for a design thinking workshop. During a design thinking workshop, volunteers can focus on an issue revealed by the survey and develop solutions they believe will remedy the problem. Having the volunteers develop their own solutions empowers them in their relationship with the organization for which they are volunteering.

Chapter 3: Results

Survey results

On June 19, 2013, an email was sent to 89 WHEP volunteers requesting their participation in an online survey to assess the motivations and satisfactions volunteers of environmentally focused programs. The survey was available for completion during the following three weeks with a reminder email going out shortly before the survey was closed. Thirty individuals responded; however, four individuals stopped answering questions part way through the survey for unknown reasons.

Demographics and basic WHEP volunteer information

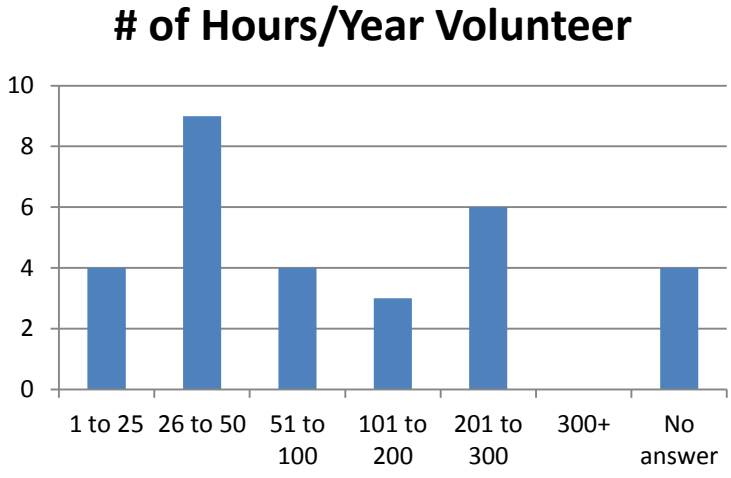
Survey respondents are relatively evenly divided between male and females. The majority of respondents are over the age of 31 with almost half of the respondents between 46 and 64 years of age. Respondents are well educated, with all having taken at least some college coursework. Eleven of the thirty respondents possess graduate degrees. The majority of respondents are employed or are currently students with a few retirees and unemployed individuals rounding out the responses. Of those employed, 8 out of 20 are employed in an environmental field.

Almost every team had at least one person respond to the survey, though the Minneapolis team represented almost half of the respondents. Survey respondents were evenly split between those new to WHEP and those who are returning WHEP volunteers. A little more than half of the returning volunteers have been with WHEP for less than five years. Of the six who have been volunteering with WHEP for five years or more, one volunteer has been with the program for 11 years, almost since the program's inception in 2000. More than half of the volunteers had previous knowledge or experience with wetlands, biology, or other related science. Two thirds of the respondents intended at the beginning of the season to continue with the program after the current season.

The majority of WHEP's means of advertising for volunteers appear to be effective in recruiting volunteers to the program. Advertising on websites for WHEP, Hennepin County, and the sponsoring cities proved to be particularly effect methods. However, traditional print mediums of newspapers and city newsletters are not far behind in recruiting a number of volunteers. Word of mouth about the program is also a popular method for volunteers finding out about the program. Beyond these methods, volunteers also heard of WHEP through coursework at Normandale Community College in Bloomington, Minnesota, and through the Master Recycler/Composter program—a Hennepin County program that trains people in waste reduction through recycling and composting, then requires them to do 30 hours of volunteer work in promoting or implementing projects aimed at waste reduction through recycling and/or composting (http://www.hennepin.us/masterrecyclers).

Thoughts on volunteering

When asked to rate on a scale of one to five how important it was for them to volunteer (with one being not very important to five being extremely important), two-thirds of WHEP volunteers



choose to answer four or five. This indicates that being a volunteer is an important part of a volunteer's life. The importance of volunteering is also evident in the amount of time WHEP volunteers have dedicated to volunteering for WHEP and other endeavors. The majority of WHEP volunteers volunteer less than 100 hours every year, but nearly a third of the volunteers dedicate more than 100 hours of their free time every year to various causes.

To achieve such a high rate of volunteering, more than half of WHEP volunteers volunteer for other causes, both environmentally and socially focused. Other environmentally focused programs include both the Master Naturalist and the Master Recycler/Composter programs, community clean-up events, Audubon Bird Counts, the Monarch Larva Monitoring Program, and land trust organizations. Socially focused programs in which WHEP volunteers participate include food shelves, the American Red Cross, social clubs like the Kiwanis, working with children in their local school district, and tutoring immigrants in their college coursework. A number of volunteers also participated in professional organizations related to their careers.

Those who volunteered for both environmentally focused and socially focused causes were asked if they perceived any differences between the two types of causes. Many of the volunteers did not perceive a difference with one volunteer stating, "It's all the greater community health that is being attended to." Another believes, "…Volunteering your time is the same no matter what cause is volunteered for. My time is still worth the same." Others, however, did perceive a difference between volunteering for the two types of causes. Those that did see a difference between the two tended to believe that there is more of an immediate effect when volunteering with social causes and that volunteering for environmental causes is more about the long-term effect. They also tended to see social causes as benefiting one type of person (e.g., homeless, hungry, illiterate), where environmental causes benefit the collective. As one volunteer explains it, "With social causes I am often directly aiding a person or group (i.e. volunteering at food shelf). With environmental causes, I am seeking to be an agent

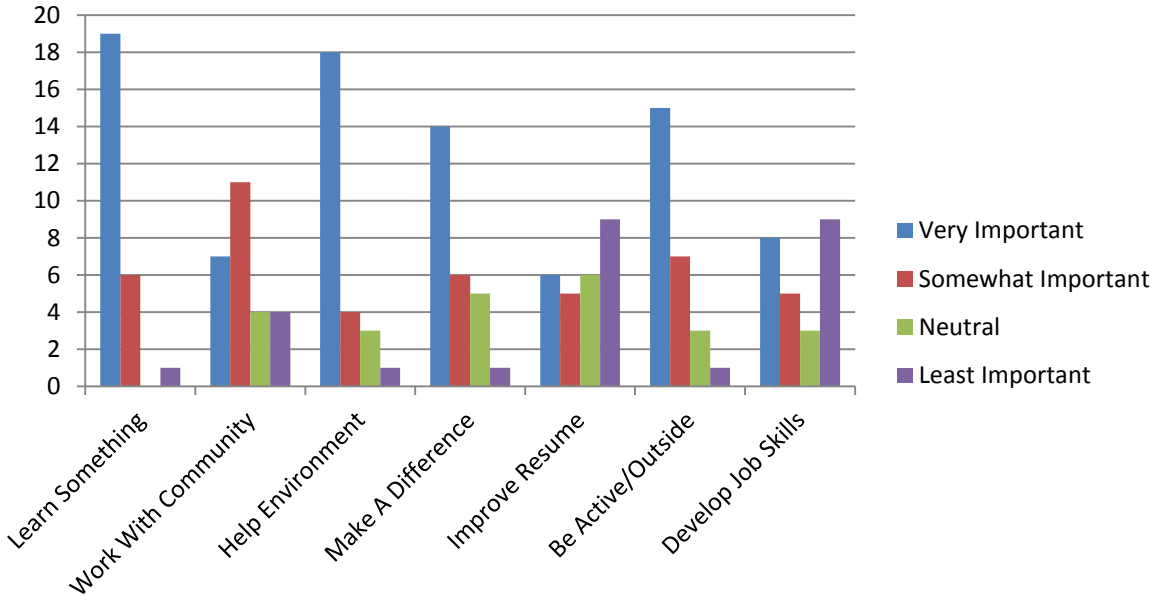
for change, influence people to engage in nature, and directly aid the environment, which then indirectly helps people in a much longer run."

Why WHEP

In order to understand why volunteers specifically joined WHEP, volunteers were asked to rank a series of statements as to what motivated them to join the program. The statements were ranked from one (the most important reason), to eight (the least important reason). The statements include:

- I wanted to learn something new.
- I wanted to work with other members of my community
- I wanted to help the environment
- I saw it as an opportunity to make a difference
- I wanted to improve my resume
- I wanted to be active/outside
- I wanted to develop job related skills
- Other, please specify _____

Respondents were allowed to give more than one motivation the same ranking and were also allowed to include a motivation that was not included as part of the survey. In



order to simplify the analysis of the results, answers of one and two were grouped together as very important, answers of three and four were grouped as somewhat important, answers of five and six were grouped as neutral, and answers of seven and eight were grouped as least important. As the above chart shows, the top motivations volunteers had for joining WHEP were to learn something new and to help the environment. This was followed closely by the desires to be active and outdoors and to have an opportunity to make a difference. Respondents found it to be only somewhat important to be working with others in their community. The motivations that held the least importance to the majority of volunteers were those that concerned their careers.

WHEP experience and the environment

Volunteers were asked several questions to ascertain how participating in WHEP has affected their attitudes and behaviors regarding the environment. When asked if participating in WHEP made them feel as though they were doing something positive for the environment, roughly half (16) of the respondents agreed or strongly agreed that they do feel they are doing something positive. This is down from the 22 volunteers who responded that they were motivated to join WHEP in order to help the environment. The reason for the 20 percent drop from those joining because of a desire to help the environment to those who actually believe they are helping is unclear from the current research. Further research will need to be conducted in order to understand this disparity.

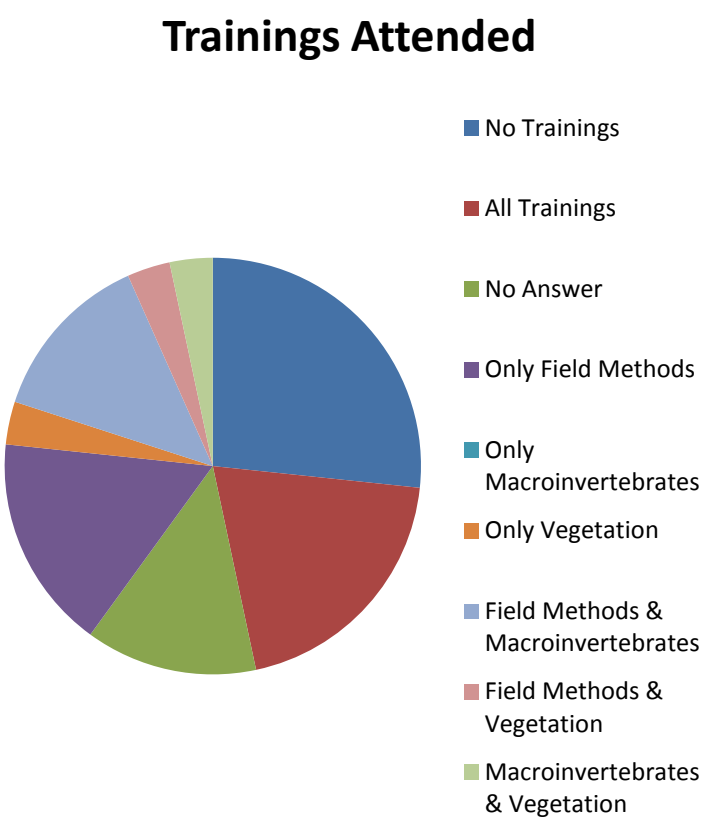
The disparity further plays out in the knowledge and understanding of environmental challenges, especially regarding water resources, gained through participating in WHEP. Only half the respondents believe that their understanding has increased because of their participation. Even fewer say that they have been inspired to do more to help the environment because of their participation in WHEP. Only eight individuals have taken steps to do more for the environment. This lack of action is not due to a lack of knowing what they could or should do. When asked if they wanted to do

more to help the environment, but were unsure of what to do, just five individuals felt a lack of knowledge was standing in their way of helping the environment more.

WHEP as a program

Training

WHEP offers its volunteers three training sessions over the course of the season. The first training, field methods, introduces volunteers to WHEP and what they will be doing in the field over the summer. The second training concerns the identification of the macroinvertebrates that the volunteers are collecting in the field at the time of training and that they will later be identifying in a laboratory setting. The third and final training concerns the identification of vegetation such as typha and lemna (i.e., cattails and duckweed) shortly before the volunteers survey the vegetation communities of the wetlands they have been assigned to monitor. None of these trainings are mandatory, and volunteers can be encouraged learn by doing with the help of their fellow volunteers, but the trainings do help volunteers to have a better understanding of what they will be doing throughout the summer. As part of the survey, the volunteers were asked which trainings they attended. They were then asked if their understanding improved due to the training(s) they attended. The volunteers were also asked if they found the structure of the training(s) to be effective.



The majority of

volunteers attended at least one training. Eight respondents did not attend any trainings; this was evenly distributed between new and returning volunteers. Almost half of the respondents (12) attended at least two trainings. The field methods training was the most attended and the vegetation training was the least attended of the three trainings.

Overall, the respondents found that their understanding of the subject of the training(s) they attended was improved as a result of attending the training(s). A few respondents had neutral feelings toward an improvement of understanding for the field methods training and only one had negative feelings toward that particular training. In regards to the macroinvertebrate and vegetation identification trainings, most of the respondents felt the structure of the trainings were effective. When given the opportunity to say what they like the most about the trainings, overwhelmingly the volunteers like the hands-on portion of both trainings where they were working with both real insects and real plants. Only two respondents for each training had negative feelings towards the structure of the trainings. When asked what they liked the least about the two trainings, there were concerns about the PowerPoint presentations for each of the two trainings with one respondent wishing they had brought a pen with to take notes on a few of the slides in the macroinvertebrate training in order to remember all of the information being presented. The majority of respondents were satisfied with the field methods training; however, this training had the most negative responses in regards to

Figure 3 Water scorpion in field sample from the 2011 season. Photo credit Jen Poate.

the effectiveness of the training. As with the macroinvertebrate and vegetation trainings, the hands-on portion of the field methods training was the most liked portion of the training and the lecture portion the least. The respondents also liked the field methods training because it was the first chance to meet their fellow volunteers.

What works, what does not, and other concerns

When asked if they had any concerns about their volunteer experience, the overwhelming majority of respondents had no concerns. Of the four individuals who did have some concerns, one wanted a better idea of the commitment that was expected of the volunteers. Another was unable to attend because the team they were assigned to only went out on weeknights and they were only available on weekends. The other two individuals, both a new volunteer and a returning volunteer, had rather alarming concerns about the management of the program. The new volunteer states they are concerned with, "poor management of citizen science leading to reduced participation." The returning volunteer says, "As a volunteer, there is a low level of appreciation by the program as a whole, though the team leader and team mates are very supportive." These volunteers are a small part of the overall program, but their opinions need to be noted and acted upon to ensure such opinions do not become more widespread.

Returning volunteers were asked what they believe did or did not work well in the past or could be improved in the future. The two main things that the returning volunteers enjoy about their experience are their team leaders and seeing their fellow volunteers year after year. Several also enjoy the program coordinator and the people who provide the training and the work that they do. Another respondent liked having their macroinvertebrate identification sessions at Normandale Community College's lab space. As for things that they would like to see improved, one of the major issues for the returning volunteers was having the macroinvertebrate and vegetation trainings so far away from where volunteers live, since the trainings are held in conjunction with the Dakota County WHEP program and are always held in Dakota County. Another issue voiced by several returning volunteers, concerns improving the expectations of all the

volunteers, since some sign up, but do not ever show up or do not continue after their first year. As one of the volunteers puts it, “The group I'm in looks like a big one but there are only a few core people who show up.” Another volunteer who was concerned about retention states, “We seem to have had a small core group for several years, but cannot retain new volunteers to the next year. Not sure why, but I think the 'rewards' for volunteering time have not met the expectations of the new volunteers.” Other concerns they had included a desire for better supplies, more opportunities to get together with other WHEP volunteers, and better pay for team leaders to help retain them year after year.

Design thinking workshop results

The design thinking workshop was held on August 10, 2013, at Westwood Hills Nature Center’s Brick House in St. Louis Park, Minnesota. Eight WHEP volunteers were able to attend the three hour workshop. The volunteers were split into two groups of four that would work together for the duration of the workshop. The program’s coordinator, Mary Karius, was also in attendance to observe (but not participate in) the proceedings. The goal of the workshop was to have the volunteers develop ideas that would improve their experience of the program and that of their fellow volunteers.

Figure 4 Design thinking workshop attendees and the author.

Kick-off

At the beginning of the workshop, introductions were made and, as the workshop's facilitator, I introduced the attendees to the concept of design thinking and how we were going to proceed throughout the workshop. The workshop roughly followed Tim Brown's three spaces of design thinking, inspiration, ideation, and implementation. The inspiration was derived from answers volunteers provided on the survey about concerns they had about the program. The workshop attendees then proceeded through the ideation space by generating ideas and then prototyped ideas. The implementation space is outside the attendees' purview. They cannot implement the ideas they generated in isolation. They must have the support and leadership of the program coordinator. The program coordinator is the person with the resources and contact information necessary to enable all the volunteers to make their ideas a reality.

The first event of the workshop was the Marshmallow Challenge (see the Methodology chapter for more details). The challenge offered the attendees the opportunity to go through the design thinking process quickly, though they did not necessarily realize this was what they were doing. They had been given a challenge (inspiration), had to come up with a structural design to hold the marshmallow as high as possible (ideation), and then build what they had designed (implementation). The challenge also served as a team building exercise as the attendees only knew at most one or two of the other attendees.

Figures 5 & 4 Workshop attendees building their structures for the Marshmallow Challenge.

Inspiration

After the Marshmallow Challenge, we focused the rest of the workshop on applying design thinking to WHEP. In order to focus the attendees on one aspect of WHEP to develop innovative solutions, I reviewed the answers volunteers had provided on the survey to find concerns volunteers had about the program. I developed two questions for the attendees:

1. How can a WHEP community be fostered during the "off" season?
2. How can active participation be encouraged during the season and in subsequent seasons?

The first question comes from the apparent desire to stay connected to the program throughout the year and not just during the summer months when WHEP is

actively sampling and monitoring wetlands. As one respondent put it, "…I feel like I have spent each year simply relearning what I did the previous year." Developing ways to maintain a connection between WHEP and its volunteers when not active can help keep the program moving forward. Maintaining the information that the volunteers need to know every year in the forefront of their minds can only help to strengthen ties between WHEP and its volunteers.

The second question overlaps the first question to a degree; however, it has more to do with encouraging new volunteers to stay involved with the program. Some had concerns about getting new volunteers who just signed up to come out and participate at all during their first season. Another respondent commented, "We seem to have had a small core group for several years, but cannot retain new volunteers to the next year." As with any volunteer organization, it is important to recruit and retain as many high quality volunteers as possible.

Ideation

With the two questions in hand, the workshop attendees worked individually to come up with ideas they thought could answer the questions. During this phase, they worked without judging their ideas and aimed to get down as many ideas as possible. As they came up with ideas, they wrote them down on post-it notes and put them up on the wall. Then each group sorted their ideas based on the subject of the idea (e.g., training ideas, field ideas, etc.). The following are the ideas generated by the volunteers, under categories I created.

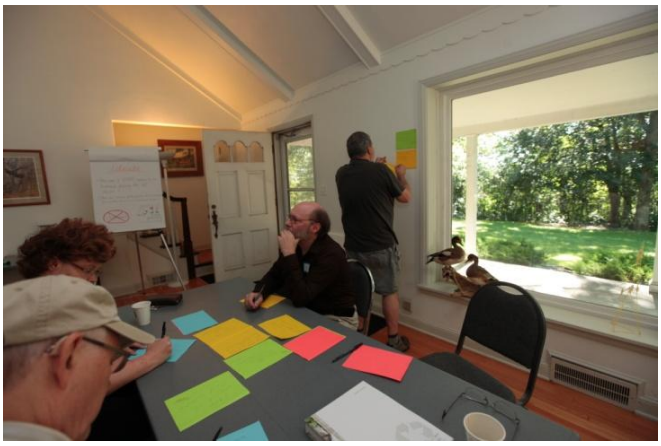


Figure 6 Design thinking workshop attendees during the ideation phase of the workshop.

Learning opportunities ideas

The workshop attendees were keen on having more opportunities to learn the necessary information to participate in WHEP. They also were interested in learning through additional workshops and classes more about wetlands and their place in our environment and impacts affecting wetlands. One attendee wanted to have a session, possibly included in one of the existing training sessions, to become more familiar with the equipment used in the field and its preparation before going out. There was more than one attendee who wanted the timing of current trainings adjusted. They wanted the macroinvertebrate identification training closer to the time volunteers are identifying what was collected in the field, not at the beginning of the season as it currently stands. The figure in a sketch one attendee drew said, "Right, that critter is a caddisfly larva. Good thing we had identification workshops a week ago. Everything is still fresh in my mind."

Figure 7 Reading through some of the ideas generated during the ideation phase of the design thinking workshop.

There were also several ideas incorporating fun social events or technology into learning the macroinvertebrate and vegetation information volunteers need to learn. There was a desire to have games developed that focused on identification of either the entire insect or plant or key features that are crucial to distinguishing among insects or plants. Platforms for these games were wide ranging, from game nights with Jeopardy- style games that would also act as social

Figure 8 Design thinking workshop attendees during the ideation phase.

functions, to games designed for online play or use on mobile devices. One attendee wanted to have a contest for the best photographs of insects or plants from the field, which could then be used in trainings.

Outreach ideas

The workshop attendees expressed a desire to reach out to the community about WHEP's efforts. They wanted to present the results to the city councils of sponsoring cities and discuss with them long term trends of what WHEP was discovering about the health of wetlands within their cities and neighboring cities. I believe they wanted to share what they've learned about the importance of wetlands to our environment. There were also a couple of ideas to reach out to the communities' youth by visiting local junior and senior high schools, potentially in conjunction with watershed district education coordinators, to talk about wetlands, their importance, and how WHEP works to assess their health. There was also a hope that these students would become future WHEP volunteers either with their parents now or later when they turn 18 years of age. There was also a desire to get the teachers involved by including WHEP in their continuing education curricula.

There was also a desire to do more than talk with others about WHEP and wetlands. Attendees wanted to expand WHEP and the Stream Health Evaluation Program, or SHEP—another Hennepin County Environmental Services' program that functions similarly to WHEP, but monitoring stream health—outstate to places like Rochester, Brainerd, and Duluth. They also wanted to create a lake monitoring program and name it LHEP for Lake Health Evaluation Program.

Internal connections ideas

One idea was to occasionally be a "guest participant" on another team, in order to be able to work with more people. During an informal conversation after the end of the workshop, the attendee who came up with this idea thought it may be easier to sometimes go out with another team (e.g., You are on the Minneapolis team because you live in south Minneapolis and your team's site for the week is in north Minneapolis, so you could become aware that the Bloomington team is visiting one of their sites on

the north side of Bloomington a few minutes from your house and you could join them that week.)

When a new volunteer starts with WHEP, there is much for them to learn from what to do in the field, which plant and insects is which, and knowing how which plants and insects living in a wetland indicate how healthy or unhealthy it is. One volunteer thought that a mentor program would be good to calm a new volunteer's nerves and help them learn what they need to know. The volunteer envisions a one-on-one partnership that would allow the new volunteer to actually perform the act in the field instead of watching someone else. This could help give a new volunteer confidence in their contribution to WHEP and, hopefully, encourage them to return year after year and become a mentor to new volunteers.

Another idea was to create a newsletter to stay in touch with volunteers and keep them apprised of what is going on with WHEP. Mary Karius, the program coordinator, liked this idea so much that she started working on ideas for the first issue then and there at the workshop and the newsletter should start being published shortly. Other ideas attendees came up with could also be included within the newsletter. They thought that in order to keep volunteers thinking about WHEP and wetlands through the winter, it would be good to broadcast to volunteers a TV schedule of programs that would be relevant to WHEP. It would also make a good forum to share what has happened in the field and create a greater sense of unity among the teams as they currently have little contact with each other beyond the trainings at the beginning of the season.

Attendees also expressed a desire to get together with their fellow volunteers. They wished to have an event where the results generated by all of the teams' efforts are presented. This would allow volunteers to see what each other has been doing all summer and give them a better idea of how healthy wetlands throughout the county are, not just the few they monitor. Another attendee wanted to have gatherings at places like coffeehouses to get to know each other on an informal, social basis.

External connections ideas

In addition to relating more with their fellow volunteers, attendees expressed a desire to connect more with other people and organizations interested in the environment beyond WHEP. They wanted to hear from the cities about what they are doing with the results generated by WHEP. They wanted to learn more about wetlands from Master Naturalists, the Minnesota Pollution Control Agency, and other organizations/agencies. This included visiting watershed districts for tours and lab demonstrations. They desire to know more about the bigger picture on our waterways, not just wetlands, by compiling all data from wetlands, lakes, and streams from all agencies monitoring water resources.

General program ideas

Several ideas do not fit into the other categories and are presented here. There were light-hearted and fun ideas like, "More t-shirts with nifty sayings! 'Scud Power'" and a desire for WHEP to go viral on YouTube. One volunteer expressed a desire to have sites located closer to their home. Another volunteer wanted more microscopes available to identify the macroinvertebrates and to have sessions to prepare equipment at the beginning of the season and then to clean it at the end.

Another idea was to have waders that turn into "Michelin Man suits" in order to stay dry when the threat of water coming over the top edge of the waders was imminent. While this idea is probably not feasible for WHEP to accomplish, it does show the workshop attendee was not passing judgment on the ideas that came to her just as a fully trained design thinker would suspend judgment during the ideation phase.

Another idea was the concept of a "party bus"—a rented bus that takes party-goers from bar to bar in order to ensure a safe night of fun—to bring volunteers to their sites. This is probably outside WHEP's operating budget, but it could be feasible to use to get volunteers to the trainings. Both the identification training sessions for the macroinvertebrates and for the vegetation are carried out in conjunction with Dakota County's WHEP program in order for the trainers from the Minnesota Pollution Control Agency (MPCA) to only take one day of their time to train all of the volunteers. These training sessions are usually held in Dakota County, meaning that some of the Hennepin

County volunteers have to drive over 30 miles one way in order to attend the trainings. Making a bus available at a central location closer to Hennepin County volunteers' homes that would transport them to the trainings could definitely improve volunteers' feelings about attending the trainings.

Prototype

Once the attendees had sorted all of their ideas, it was time to choose one of the ideas to turn into a prototype. There were several ideas for making it easier to learn all of the macroinvertebrates and vegetation, including games and applications for personal electronic devices. So one team created an iPhone app game that quizzes players on different wetland insects and plants. The app would allow volunteers to brush up on what they learned in training whenever and wherever they choose, possibly even in the field or lab when they are having trouble identifying something. It also makes learning a large amount of information more fun for the volunteers.

Figures 9 and 10 One group building their prototype and the finished prototype.

Many of the ideas also conveyed a desire to get more involved with the communities the wetlands are a part of and do more outreach to create awareness for WHEP and wetlands in general. The other group prototyped a way to get more involved with junior and senior high school students by going to talk to them about wetlands and WHEP whenever wetlands or ecology are being discussed in their classes. The hope behind this is two-fold. One hope is to increase awareness about wetlands and their importance for our ecosystems. The other hope is to get the kids interested enough to

Figures 11 and 12 The other group building their prototype and the finished prototype.

join WHEP either with their parents when they are under age or on their own once they turn 18. Attending the classes would not only be outreach, but a means of recruiting new volunteers.

During the design thinking workshop, the volunteers used information derived from the earlier survey as their inspiration for finding solutions for engaging volunteers during the season and for creating bridges between seasons to keep volunteers filled with enthusiasm about the program. Through the ideation phase, they generated a number of ideas that could help to solve these issues. WHEP could go forward with implementing almost any of the ideas and make them a standard part of the program. Overall, I believe the design thinking workshop was a success. The attendees also appeared to be enjoying themselves while they went through the design thinking process of ideation and prototyping. Using a design thinking workshop with volunteers to devise ways to improve the volunteer experience is a viable option for a program. It also shows that a design thinking workshop is a good way to reason out solutions to problems in a collaborative environment.

Chapter 4: Discussion

Recommendations for WHEP

The results of the survey and the design thinking workshop have provided WHEP with many avenues to pursue which could help strengthen the program by recruiting more volunteers and working to retain more of their volunteers each year. Presented below are a selection of the recommendations I believe would be easier to implement than some other ideas and would provide great benefit to the program and its volunteers.

Recruitment

As the survey showed, the majority of ways that Hennepin County Environmental Services advertises to recruit volunteers for WHEP are effective. However, there are opportunities for recruitment that are not being exploited. Several of the volunteers indicated that they are Master Naturalists. The Minnesota Master Naturalist volunteer program trains people in the state's natural history—in one of its three biomes of boreal forest, hardwood forest, and prairie. Once a person has completed training in one of the biomes, they become a certified Master Naturalist.

In order to maintain their certification, Master Naturalists must complete 40 hours of volunteering each year in four potential areas: stewardship, education/interpretation, citizen science, or program support. (Minnesota Master Naturalist, 2013). Master Naturalists are people who want to be connected to the environment and need to meet a quota for volunteer hours participating in programs like WHEP. Actively recruiting Master Naturalists benefits both the Master Naturalist and WHEP.

Another potential source of volunteers was revealed in the survey by half of the respondents who heard about WHEP through means other than WHEP's traditional recruitments. These volunteers had heard about WHEP through a class and posters at Normandale Community College. There are several community colleges in Hennepin

County, including Normandale, Minneapolis Community and Technical College, and North Hennepin Community College. All three colleges offer coursework in biology or ecology, and Minneapolis Community and Technical College even has a set of courses exploring environmental challenges we are facing called “Race to Save the Planet” (Minneapolis Community and Technical College, 2013; North Hennepin Community College, 2013; Normandale Community College, 2013). The students at these colleges and their science programs are a good potential source of volunteers for WHEP. WHEP would offer these students hands-on field experience, something that may be helpful to their future careers. Making connections with the instructors at these colleges could also be beneficial to WHEP. Normandale offers two WHEP teams laboratory space to identify the macroinvertebrates that they collect in the field. Developing relationships with the instructors could make more laboratory space available to the program and this is desperately needed.

Several of the volunteers who responded to the survey indicated that they worked in an environmental field. This indicates a willingness and desire of some who spend their professional lives working to benefit our environment to spend their free time working to benefit the environment as well. Targeting these individuals for recruitment would provide WHEP with a pool of volunteers with a strong commitment to our environment. WHEP could reach out to local environmental professional organizations to entice more volunteers to join WHEP. For example, both the Minnesota Association for Environmental Education and the Minnesota Naturalists’ Association’s memberships are dedicated to teaching others about our environment, and therefore becoming volunteers for WHEP would give these people a strong foundation for teaching others about wetland habitats and their importance to the wider ecosystem. Another good organization to reach out to would be the Women’s Environmental Network which aims to connect women in environmental fields to one another because they post a variety of environmental volunteer opportunities on their website (Women’s Environmental Network, 2013).

A pictorial recruitment method and general advertising for WHEP was developed by one of the volunteers who attended the design thinking workshop. The idea was to create a series of signs that the teams could put out at sites that are monitored in park settings that would have foot or bike traffic passing by. The signs would tell people that the wetland's health was in the process of being monitored, where they can find more information about the health of wetlands in the area, and how they can get involved with WHEP. This is a relatively inexpensive option to spread the word about WHEP and reach potential volunteers at the same time.

Collaboration

One of the main themes of the ideas generated at the design thinking workshop was collaboration. The volunteers showed a strong desire to meet, to work with, and to get to know their fellow volunteers better. This desire also extends beyond members of WHEP. The volunteers wanted to connect with other organizations and state agencies that work to monitor and manage our water resources in order to learn more about the condition of our waters. They want to be able to see the bigger picture and their role in it. They also want to engage the general public, both as a means of recruitment and, more importantly, to make the general public more aware of the critical importance of our wetlands to the whole environment.

To start building a more collaborative environment, it is best to work internally first and then move outward to engage those outside of WHEP such as watershed district personnel and the general public. Of all the collaborative ideas generate generated at the design thinking workshop, one of the easiest to implement is the idea of occasionally allowing WHEP volunteers to be guest participants with another team. This would allow the volunteers to meet and get to know more of their fellow volunteers, thus increasing the ties they have to the organization. It may also give a team a boost on a night when not many of the team's regular volunteers are available. Enacting this idea would not be very difficult. All teams use Google Calendar to post when they will be at a site and where the site is. Team leaders would only need to

include all WHEP volunteers among those who are able to see their calendar instead of just their own team's volunteers. Volunteers would need to be given the contact information for all team leaders in order to be able to inform the team leader that they would be a guest participant with their team.

Another idea the workshop attendees came up with was to have game nights throughout the off season with games that reinforce the insect and plant identification information the volunteers learn during the season. In addition to keeping in mind what they learned, it would also provide volunteers a chance to interact with volunteers from other teams. These game nights could be held in the meeting rooms of libraries as they are typically free of charge to rent. It would also allow the game night to move around Hennepin County, so no one would be burdened by constantly having to travel further than others who come as would be the case with a fixed location. The biggest expenditure WHEP would have with implementing this idea would be finding existing games or developing new games to be used. They may also consider providing light refreshments as an incentive to the volunteers to participate.

External relations between volunteers and the communities for which they are monitoring could also be strengthened. At present, volunteers do not, for the most part, get to meet the liaison for the city who chooses which sites the volunteers will be monitoring and know what the city is doing with the information. These people could be invited to come to one of the training sessions or to the game nights to talk with the volunteers about how they use the data generated by the volunteers. This would give the volunteers a good sense of what the data can mean to a city and show them that they are making a contribution to the community and the environment.

At least a couple of volunteers have connections to watershed districts within Hennepin County. These volunteers could be used to establish a connection with the districts. One of the volunteers suggested a tour of one of the district's facilities so volunteers could get a firsthand look at the research and other efforts the watershed districts are doing to improve the quality of water. This connection would allow

volunteers to see the bigger picture of the quality and importance of our water resources.

One of the design thinking workshop attendee's expressed the somewhat complex desire to see WHEP becoming eligible for continuing education for teachers to retain their licenses. This may be a complicated avenue to pursue, but it would certainly open up a whole new area of volunteer recruitment for WHEP. It would also potentially create an inroad into the classroom to teach children about wetlands and what WHEP does. This latter point was another issue that the some of the attendees of the design thinking workshop prototyped happening and showed great interest in making it happen and also participating in it. It became clear that WHEP has many directions in which it can go. The ideas generated by its volunteers can only make it a stronger program.

Broader implications

Limitations

There are drawbacks to using design thinking. In some instances, the ideas generated can, in hindsight, be quite obvious solutions. For instance, a few years ago, students at the design thinking school Knowmads in the Netherlands worked with KLM—the Dutch royal airline, to improve the experience of KLM's business passengers. KLM had already streamlined the check-in process and introduced Wi-Fi to their planes in order to enable business passengers to carry on with their work. Yet this did not satisfy their business passengers. What Knowmads students found by talking to business passengers is that they actually liked having the down time travel created in their day and enjoyed meeting and networking with their fellow passengers (P. Spinder and F. Krüger, personal communication, March 27, 2012). With this knowledge gained by listening to the business passengers instead of assuming to know what they wanted, the students developed an online check-in system that allows their passengers to choose their seatmates after reviewing the social networking site of fellow passengers to see if they have any common interests. Business passengers now enjoy a flight that meets

their needs. However, KLM had gone directly to their business passengers and asked them how to make their flights better, they probably could have developed themselves a similar check-in system to that of Knowmads' students. Thus, in this case, bringing in outside experts did not seem to be entirely justified.

Similarly, having an outsider come into a program, as I did, to assist the organization through the design thinking process does not necessarily lead to implementation of ideas and prototypes generated through the process. It seems to me that an organization and those with the power to implement the ideas generated by any design thinking process and make suggested changes must fully support the process throughout. If volunteers of an organization go through the design thinking process and do not see the results of the process being implemented they may well become disheartened by the lack of follow through. This could also lead the volunteers to disengage from future endeavors. It could also lead to a feeling of disenfranchisement from the organization as a whole, causing the exact opposite of the desired effect.

In order to avoid this, the organization must fully support the design thinking process and work to ensure implementation of at least some of the ideas. The full support of the organization is critical; however, it is even better when the organization specifically sets itself up for innovation and creates a culture that integrates design thinking into the fabric of who they are as a company. Tim Brown (2009) offers several examples of companies who have done this. His company, IDEO, worked with the Taiwanese computer company Acer on several projects and were told by their cultural liaison, Professor David Liang, that, "'They liked the fish. Next time give them the net,'" meaning teach them how to be design thinkers themselves, rather than merely participants in the process (p. 171). So the next time they went to Acer, IDEO did not go because of a specific project, but went to teach Acer's employees to become design thinkers themselves. Design thinking can only be a strong agent of change for an organization when there is a strong willingness to support innovation and change within the organization.

Advantages

Although we have seen there are some limitations, design thinking is a useful process an organization can undertake to develop innovative solutions to issues it may be having. One of design thinking's biggest advantages is that anyone would be able to be taught how to go through the process to develop solutions. One does not need to go through extensive training or to spend a large amount of money on an outside consultant to have the design thinking process become successful. Resources are widely available to guide an organization through the process. The University of Stanford's Hasso Plattner Institute of Design or d.school has focused on training its students on using design thinking and has made the process they teach available on their website (http://dschool.stanford.edu/use-our-methods/) for all who desire to try design thinking themselves to solve particular problems. The design thinking company IDEO has developed a toolkit aimed at educators to help them through the design thinking process to not only create new curriculum, but "address[ing] problems in the classroom and across entire districts" (IDEO, n.d.). Both of these guides to design thinking are easy to follow and provide a good understanding of what design thinking is all about.

Another advantage of design thinking is its ability and willingness to tackle large, apparently unwieldy problems. This is especially important given the complex and crucial social and environmental challenges, which our world is currently facing and which are critically in need of solutions. Our contemporary modes of consumption of goods is often out of equilibrium with the social and environmental needs of the planet and the people living on it. As Tim Brown (2009) puts it, "Holding the economic sustainability of society and the biological sustainability of the planet in balance requires the most 'opposable' of minds" (193). Design thinkers possess such minds.

How design thinkers contribute to a more sustainable planet is widely varied. It can be an artistic endeavor like the works of Chris Jordan who creates graphic images that upon closer inspection reveal the extent of our consumerist society (Brown, 2009). For example, in *Caps Seurat* Jordan recreates Georges Seurat's (1859-1891) *A Sunday*

Afternoon on the Island of La Grande Jatte (1886) using the images of 400,000 plastic bottle caps which represents the number of bottle caps consumed in the United States each minute (Jordan, n.d.).

Another contribution could take the form of a more sustainably created product. Designer William Mc Donough and chemist Dr. Michael Braungart have been working with companies to persuade them think beyond the creation of their products and their rejection of when the consumer is finished with them to thinking "cradle to cradle". The concept of cradle to cradle is to think of a product's entire lifecycle from the sourcing of the raw materials to what happens to the manufacturing process to the product's use by the consumer to what happens to the product after it enters the waste stream and working to ensure that every step along the way is a sustainable one, both environmentally and socially (McDonough Braungart Design Chemistry, 2013).

Design thinking can also help to develop strategies to change people's less than sustainable actions. IDEO worked with the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy to develop strategies targeting consumers in regards to energy-efficient products. During the course of their work, IDEO discovered that energy efficiency held little meaning to consumers. To be more effective the Office of Energy Efficiency and Renewable Energy would need to move from concentrating on engineering advances in energy efficiency to meeting people at their current level of understanding and raising their awareness of the importance of energy efficient products in their lives through informational and educational materials and more appealing products and retail displays (Brown 2009). Thus, design thinking has the capability of changing our world for the better through awareness, changing business practices and people's behavior to more sustainable actions.

Conclusion

Given the challenges we are facing due to deteriorating environmental conditions, it is essential to understand how and why people are getting involved with monitoring and managing their local environment in order to get to know and improve their local environmental conditions. With a better understanding of why people are getting involved, we can build on the number of people willing to get involved by searching out other individuals similar to those already involved. The more people become involved in working to understand and improve our environment, the better chance we have to stem the deteriorating conditions of our environment.

WHEP gives people the opportunity to get involved with monitoring wetlands, which are a crucial component of our environment. Part of my thesis has focused on who WHEP volunteers are, what encouraged them decide to participate in WHEP, and why those that return year after year do so. It has become clear that WHEP volunteers show a strong desire to help the environment, and strive to make a difference, they can and do make important contributions. They are also a well-educated, professional group of people looking to learn something new, and this is something that must be kept in mind when recruiting new volunteers and developing ways to better engage them once they are with the program. The volunteers are largely satisfied with their experience, but as with everything and anything there is always room to improve.

My thesis has focused on a small group of volunteers of an environmentally focused citizen science program run by a branch of local government. More research needs to be done to know what motivates people to join environmentally focused programs as volunteers and continue to volunteer for their chosen program. Do all volunteers of environmentally focused programs have similar motivations to those of WHEP volunteers?

My thesis also explores how design thinking can be used to create a pathway to improve an organization's relationship with its volunteers. During a design thinking

workshop, WHEP volunteers generated many ideas they would like to see implemented, because they thought that such ideas would improve their experiences and that of their fellow volunteers. I believe that the majority of these ideas could be successfully implemented. A one-to-one mentorship of new volunteers to help them learn the skills they need to be successful in their efforts with WHEP could certainly help retain more volunteers from season to season. Among the volunteers who participated in the design thinking workshop, there were also many great ideas, from newsletters to game nights and social hours, to help foster a stronger sense of community among one and all.

I believe all these results demonstrate how design thinking can be a useful tool for organizations that use volunteers and also could be valuable in other organizations with environmental or social foci and concerns. Pairing a survey of the psychological motivations and satisfactions of volunteers with a design thinking workshop encourages an organization to discover and foster the inspiration and motivation of their volunteers. The next step is to develop and implement the innovative solutions to issues that have emerged in the ideation phase of the workshop itself. Together, psychology and design thinking can thus encourage members of an organization to begin with the familiar and then develop new ideas that will lead them to investigate territory they might previously never even thought of exploring.

Appendix A: Survey questions

1. Age: 18-22, 23-30, 31-45, 46-64, 65+

2. Gender: Male/Female

3. Occupation: -Employed in environmental field

-Employed in a non-environmental field

-Unemployed

-Student

-Retired

4. Education: -Less than high school

-High school

-Some college

-AA/AS

-BA/BS

-Graduate degree

5. WHEP Team: - Elm Creek Watershed

- Minneapolis

- Bloomington

- Minnetonka

-Eden Prairie

6a. Are you a new or returning volunteer?

6b. if returning, how many years have you been with WHEP?

7. Do you plan to continue with WHEP after this year: Yes, No, Unsure

8. How did you hear about WHEP: -Community newspaper

-WHEP or Hennepin County website

-Friend/family

-City website

-City newsletter

-E-newsletter

-Other, please specify _____

9. How important do you consider it for you to volunteer in general, not just for WHEP? Sliding scale-not very to extremely important (1-5 point, for all sliding scale questions)

10. Please rate the following factors that motivated you to join WHEP with 1 being the most important and 8 being the least important.

-I wanted to learn something new.

-I wanted to work with other members of my community

-I wanted to help the environment

-I saw it as an opportunity to make a difference

-I wanted to improve my resume

-I wanted to be active/outside

-I wanted to develop job related skills

-Other, please specify _____

11a. Do you volunteer for more than just WHEP?

11b. If yes, what type of organization or program do you volunteer for?

12a. Do you volunteer for social causes? Yes/No

12b. if yes, do you perceive any difference between volunteering for social causes versus environmental causes? Please explain. Yes, open ended/No, open ended

13. Approximately, how many total hours per year do you volunteer? Please include all volunteer hours not just those for WHEP. 1-25, 26-50, 51-100, 101-200, 201-300, 301+

14. What are you most anticipating or hoping to get out of this volunteer opportunity?

15. Do you have any previous experience or knowledge about wetlands, biology, environmental studies, or other related science?

16. Volunteering for WHEP makes me feel as though I am doing something positive for the environment: sliding scale strongly disagree to strongly agree

17. Volunteering for WHEP increased my knowledge/understanding of environmental challenges, especially regarding water resources: sliding scale strongly disagree to strongly agree

18. Volunteering for WHEP has made me take additional steps to help the environment: sliding scale strongly disagree to strongly agree

19. I would like to take additional steps to help the environment, but am unsure of what I can do: sliding scale strongly disagree to strongly agree

20a. Did you attend any of the trainings? Yes/No for Field Methods, Macroinvertebrates, Vegetation

20b. If yes, please rate your understanding after the training:

-Field Methods: sliding scale little understanding to much better understanding

-Macroinvertebrates: sliding scale little understanding to much better understanding

-Vegetation: sliding scale little understanding to much better understanding

20c. If yes, did you find how the training was structured to be effective: sliding scale strongly agree to strongly disagree

-What was the most valuable part: open ended

-What was the least valuable part: open ended

21. Do you have any concerns about your volunteer experience? No. Yes, please explain

22. If you're a returning volunteer, what do you think has worked well in past years? Open ended

23. If you’re a returning volunteer, what do you think has not worked well in the past or could be improved? Open ended

Thank you for your time and input.

Appendix B: Ideas generated at the design thinking workshop

The following ideas were generated by WHEP volunteers during the ideation phase of the design thinking workshop held on August 10, 2013.

- Are there any Android or iPad apps that would be “fun” to use in the field?
- Game night with ID as part of game so remember to ID.
- Jeopardy game! Question the type of critter or critter parts
- Go to school junior high/HS when teaching units on wetlands to get kids interested in programs
- Sometimes, be a “guest participant” in somebody else’s group. The idea is to work with different people, but not all the time.
- Online game with matching macroinvertebrate to the adult form
- Share moments of field collection
- Feedback from the city to the volunteering group
- Presentation to city council on results and long term trends
- Discuss importance of wetlands
- More t-shirts with nifty sayings! “Scud Power”
- Invite Master Naturalists to discuss wetland hydrology.
- Photos with iPhones of macro/plants bugs in wetland close-up award the best use to teach
- School visits with WD (*watershed district*) education coordinators with wetland results

- Off season assignments or volunteering efforts that support our summer work.
- During the season, it really helps when an experienced person "mentors" other people, especially 1:1 (one to one) so you have to actually do (whatever) rather than just watch.
- Coordinate data on wetlands, lakes (WD) and streams in a metro ??? watershed and get picture of IBI (*index of biological integrity*) for whole area involve all cities and WD
- Somebody volunteers to check the TV schedule, to inform others when "relevant" programs will be on (usually KTCA). The idea is to keep people "thinking about it" during the winter.
- Off season learning sessions/classes on impacts to wetlands
- Newsletters
- ID workshops closer in time to labs
- Have WHEP or SHEP included as part of continuing education for school curricula
- More microscopes!
- Results event
- Michelin Man suits (*inflate to keep from topping off waders and getting wet*)
- Close to home
- WHEP/SHEP goes viral on YouTube
- Identification events later in the summer, after sites but before lab ident. *From drawing figure*: Right, that critter is a caddisfly larva. Good thing we had identification workshops a week ago. Everything is still fresh in my mind.

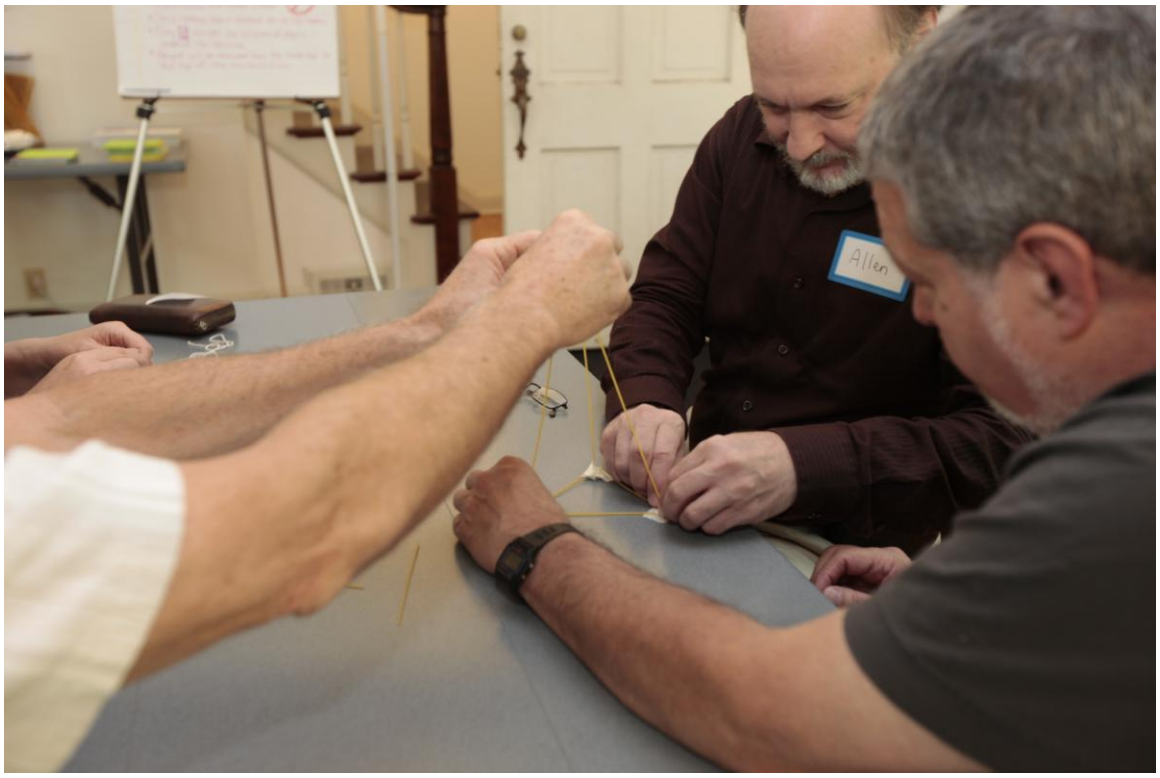
- Party bus concept/ (also it provides transportation)
- Equipment prep/familiarize get togethers this could include both sessions: gathering and analyzing bugs
- Have speakers from the Pollution Control Agency, city governments and other agencies come talk to our group(s).
- Try to get WHEP and SHEP introduced to outstate Minnesota (i.e. Rochester, Brainerd, Duluth)
- Establish a lake monitoring program too (called LHEP?)
- WHEP advertising *Sign*: Come join WHEP! Now! (We need you)
- Visit watershed district offices during off-season (i.e. tours, lab demos)
- Equip prep, Equip clean
- Coffee house socials or whatever. Social get togethers
- Workshop learning events
- Lab in late winter

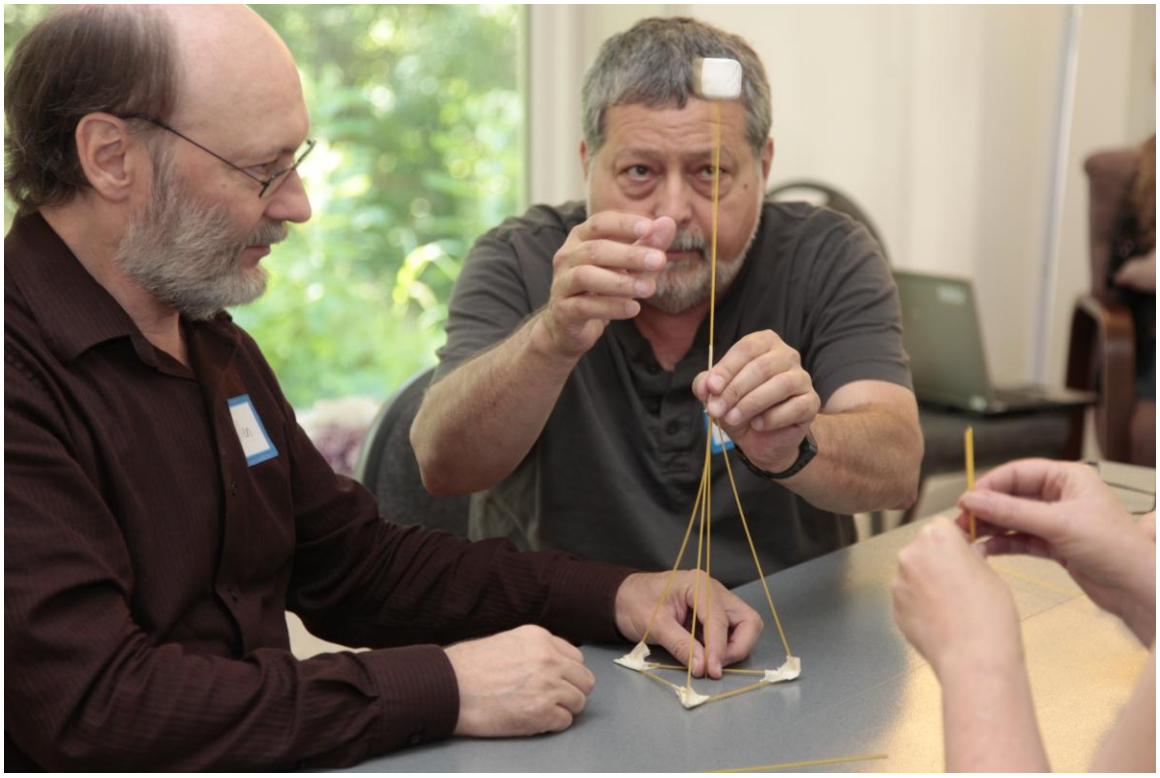
Appendix C: Additional design thinking workshop photographs


Workshop Goal:
To develop innovative ways to improve the WHEP volunteer experience


What is design thinking?
Principles
1 Human centered/empathetic
2 Bias towards action
3 Prototype driven
4 Mindful of the process


TRASH


Allen




Allen


Nick
Quondo Omni
Tunkus Mortati


Marshmallow Challenge


Marshmallow Challenge
Goal: Build the tallest free-standing structure with a marshmallow on the top
Rules:


TRASH


RASH


Ideate


Prototyping


TRASH


TRASH


Crayons


Sherry
WHEE


WHEP


VEG & CRITTER APP
YOUWIN!

References

Alabri, A. & Hunter, J. (2010). Proceedings from the Sixth IEEE International Conference on e-Science: *Enhancing the quality and trust of citizen science data*. Brisbane, Australia.

Berger, W. (2009). *CAD Monkeys, Dinosaur Babies, and T-Shaped People: Inside the World of Design Thinking and How It Can Spark Creativity and Innovation* Penguin Books, New York.

Bonney, R., et al. (2009). Citizen science: A developing tool for expanding science knowledge and scientific literacy. *BioScience*, *59*(11), 977-984.

Brossard, D., Lewenstein, B., & Bonney, R. (2005). Scientific knowledge and attitude change: The impact of a citizen science project. *International Journal of Science Education*, *27*(9), 1099-1121.

Brown, T. (2009). *Change By Design.* HarperCollins, New York.

Carpenter, J. & Knowles Myers, C. (2010). Why volunteer? Evidence on the role of altruism, image, and incentives. *Journal of Public Economics, 94*, 911-920.

Conrad, C.C. & Hichey, K.G. (2011). A review of citizen science and community based environmental monitoring: Issues and opportunities. *Environmental Monitoring Assessment*, *176*, 273-291.

Genet, J. (2012). *Status and trends of wetlands in Minnesota: Depressional wetland quality baseline* (Doc. No. wq-bwm1-06). St. Paul, MN: Minnesota Pollution Control Agency.

Gifford, R. (2007). Environmental psychology and sustainable development: Expansion, maturation, and challenges. *Journal of Social Issues*, *63*(1), 199-212.

Hennepin County. (2013). *Hennepin County Master Recyclers/Composters.* Retrieved from http://www.hennepin.us/masterrecyclers

IDEO. (n.d.). *What kind of challenges can be addressed using Design Thinking.* Retrieved from http://designthinkingforeducators.com/design-examples/

Jordan, C. (n.d.) *Running the numbers: An American self-portrait.* Retrieved from http://www.chrisjordan.com/gallery/rtn/#caps-seurat

Lewton, A.R. & Nievar, M.A. (2012). Strengthening families through volunteerism: Integrating family volunteerism and family life education. *Marriage & Family Review*, *48*(7), 689-170.

Manning, C. (2009). *The psychology of sustainable behavior* (Doc. No. p-ee1-01). St Paul, MN: Minnesota Pollution Control Agency.

Mason, C. (2002). *Biology of Freshwater Pollution* (4th ed.). Harlow, England: Pearson Education Limited.

Mayer, A. (2010). Phenology and citizen science. *Bioscience, 60*(3), 172-175.

McDonough Braungart Design Chemistry. (2013). *Cradle to cradle: Beyond sustainability.* Retrieved from http://www.mbdc.com/cradle-to-cradle/c2c-framework/

Miller-Rushing, A., Primack, R., & Bonney, R. (2012). The history of public participationin ecological research. *Frontiers in Ecology and the Environment, 10*(6), 285-290.

Minneapolis Community and Technical College. (2013). *Race to save the planet.* Retrieved from http://www.minneapolis.edu/Educational-Programs/Liberal-Arts-General-Education/Race-to-Save-the-Planet

Minnesota Master Naturalist. (2013). *About Minnesota Master Naturalist.* Retrieved from http://www.minnesotamasternaturalist.org/about/

National Aeronautics and Space Administration. (2013). *For citizen scientists.* Retrieved from http://science.nasa.gov/citizen-scientists/

Normandale Community College. (2013). *Biology.* Retrieved from http://www.normandale.edu/academics/stem-and-education/biology.html

North Hennepin Community College. (2013). *Biology A.S..* Retrieved from http://www.nhcc.edu/academic-programs/degrees-and-certificates/science-mathematics/biology-as

Silvertown, J. (2009). A new dawn for citizen science. *Trends in Ecology & Evoluntion, 24*(9), 467-471.

Sloman, S. (1996). The empirical case for two systems of reasoning. *Psychological Bulletin, 199*(1), 3-22.

Thoits, P.A. (2012). Role-identity salience, purpose and meaning in life, and well-being among volunteers. *Social Psychology Quarterly*, *75*(4), 360-384.

Vecina, M.L. & Chacón, F. (2013). Volunteering and well-being: Is pleasure-based rather than pressure-based prosocial motivation that which is related to positive effects? *Journal of Applied Social Psychology*, *43*, 870-878.

Vecina Jiménez, M.L., Chacón Fuertes, F., & Sueiro Abad, M.J. (2010). Differences and similarities among volunteers who drop out during the first year and volunteers who continue after eight years. *The Spanish Journal of Psychology*, *13*(1), 343-352.

Women's Environmental Network. (2013). *Ongoing volunteer opportunities.* Retrieved from http://wenmn.org/job-board/ongoing-volunteer-opportunities/

Wujec, T. (n.d.). *The marshmallow challenge.* Retrieved from http://marshmallowchallenge.com/Welcome.html